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Gélinas et al.

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(54) **RESPIRATOR**

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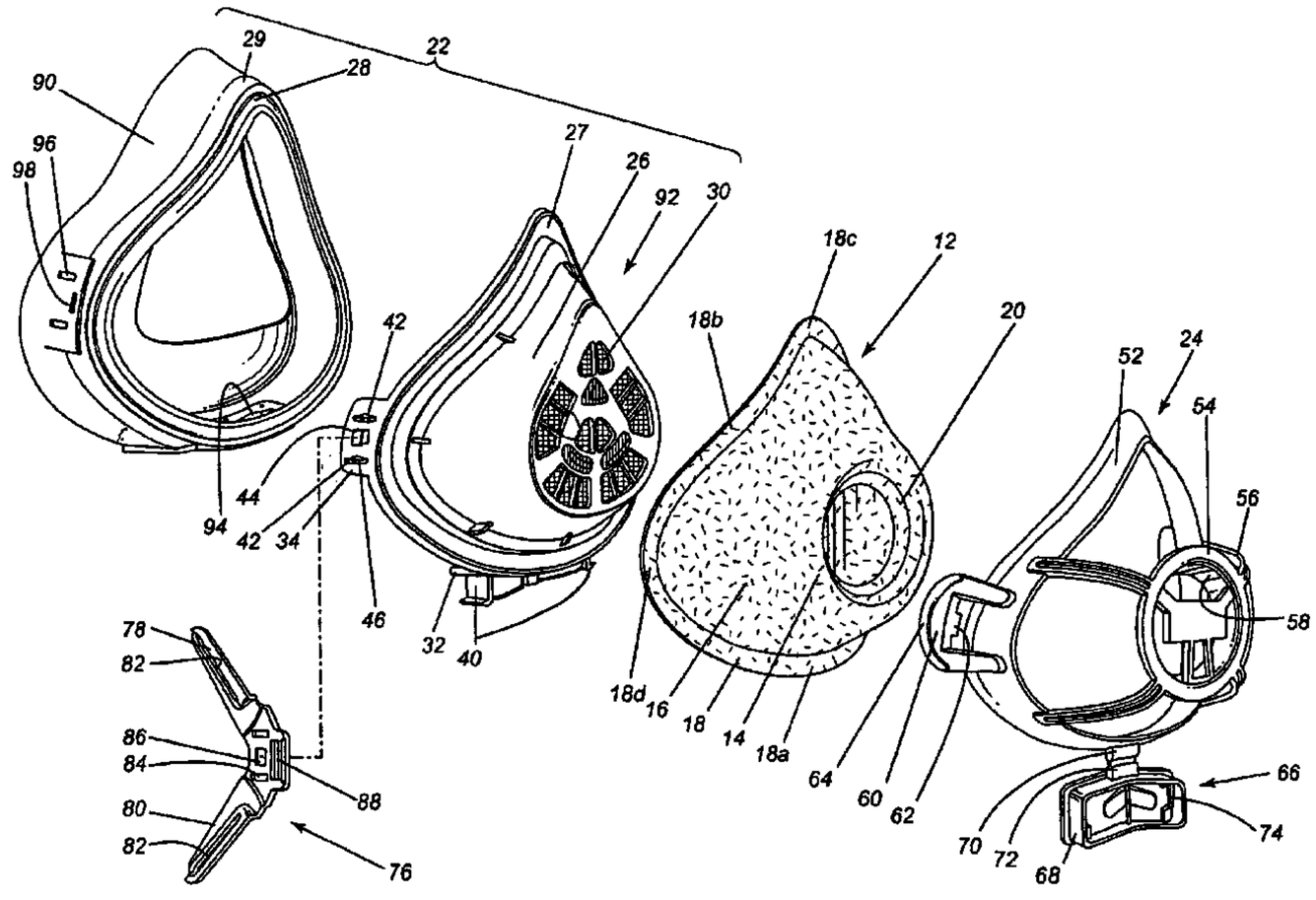
(57) **ABSTRACT**

A respirator comprising a facepiece having a cup shaped portion for sealingly engaging a face of a wearer and covering the mouth and nose of the wearer and a cover having a cup shape that is complementary to the cup shaped portion of the facepiece. The cover is capable to detachably mate with the facepiece to define with the facepiece a void area that is cup-shaped and suitable to receive a filter having a complementary shape. The filter includes an apex portion, a side portion depending from the apex portion and a continuous flange portion surrounding said side portion and projecting laterally therefrom.

30 Claims, 7 Drawing Sheets



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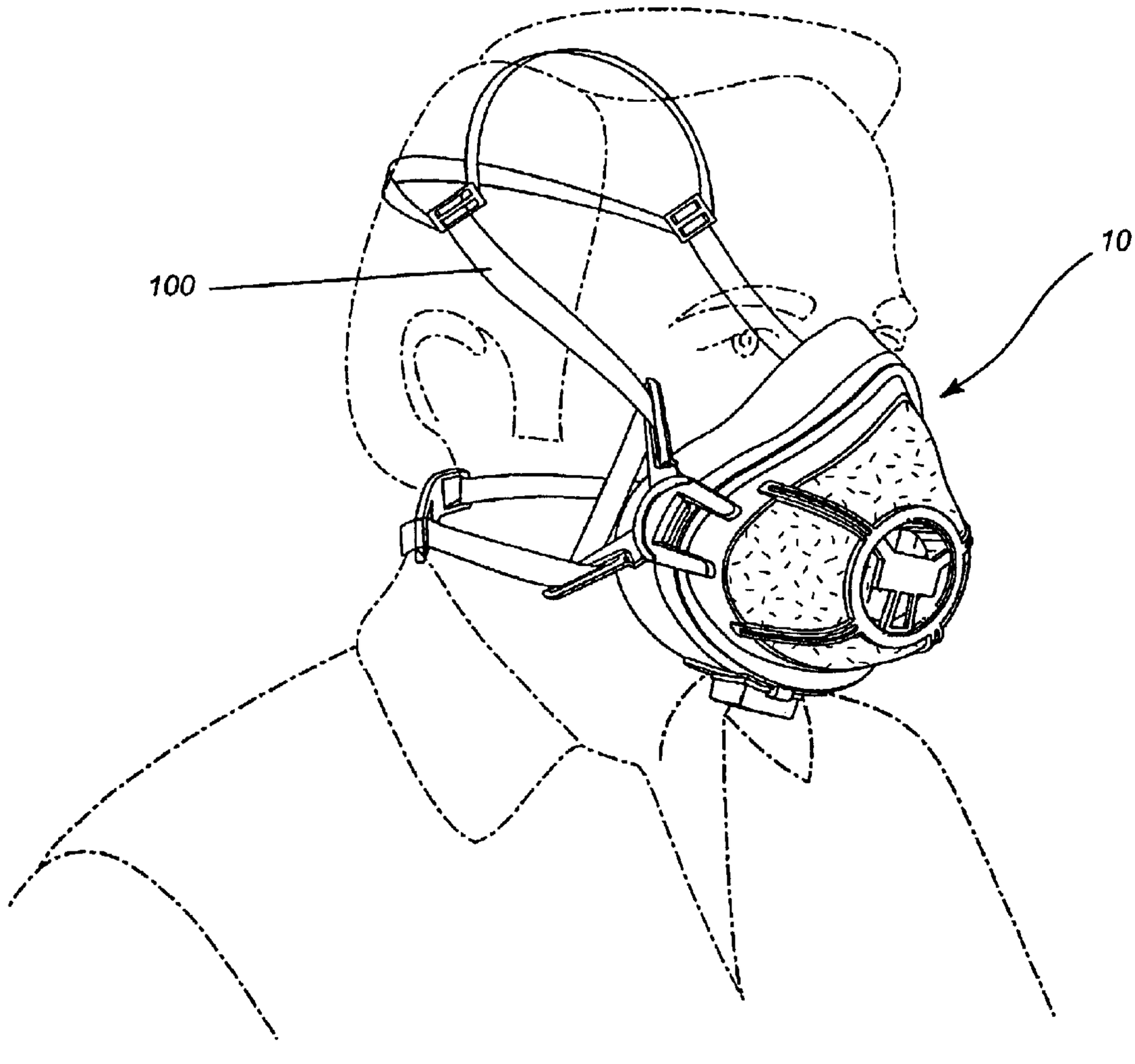

Fig. 1

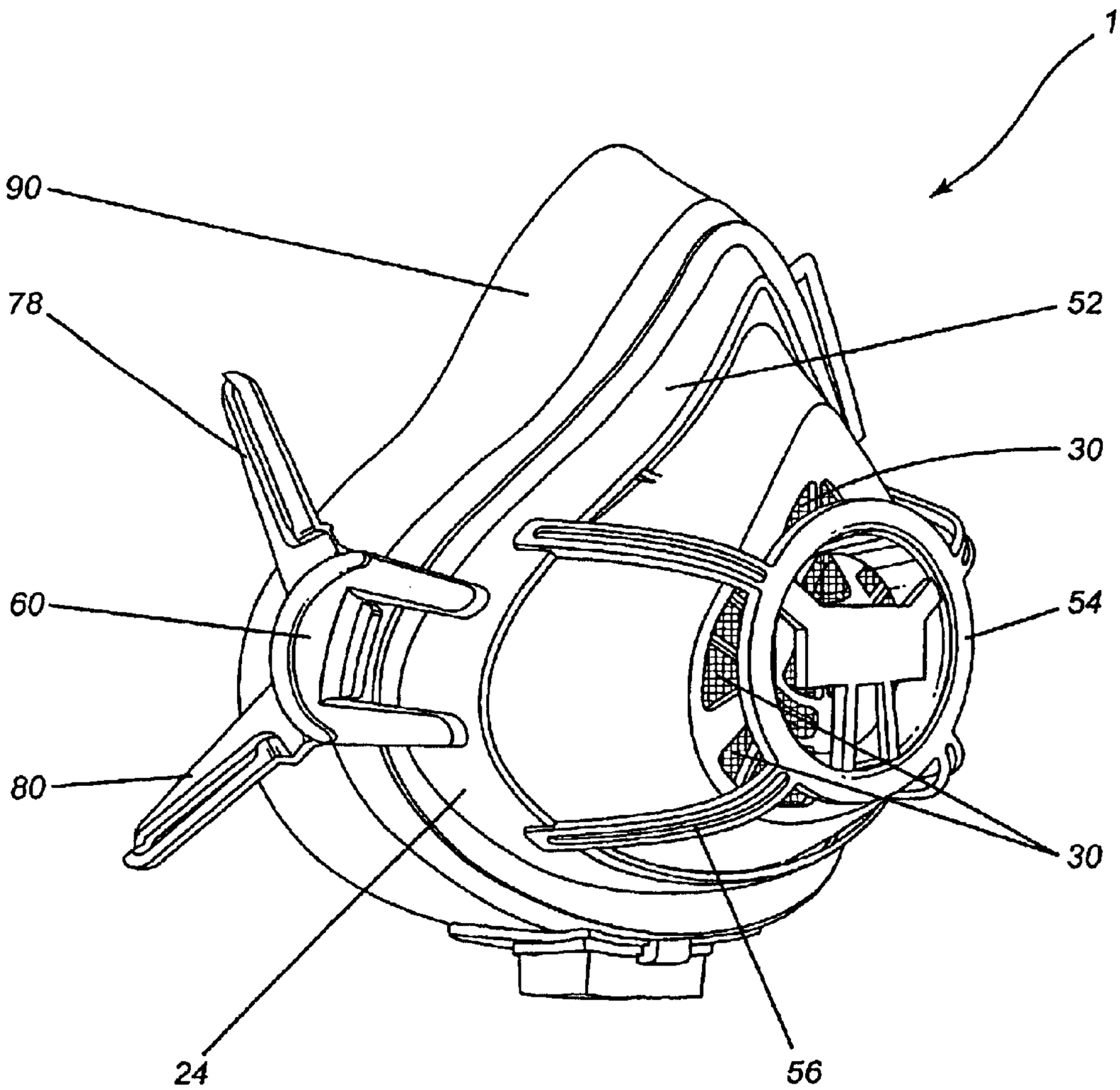

Fig. 2

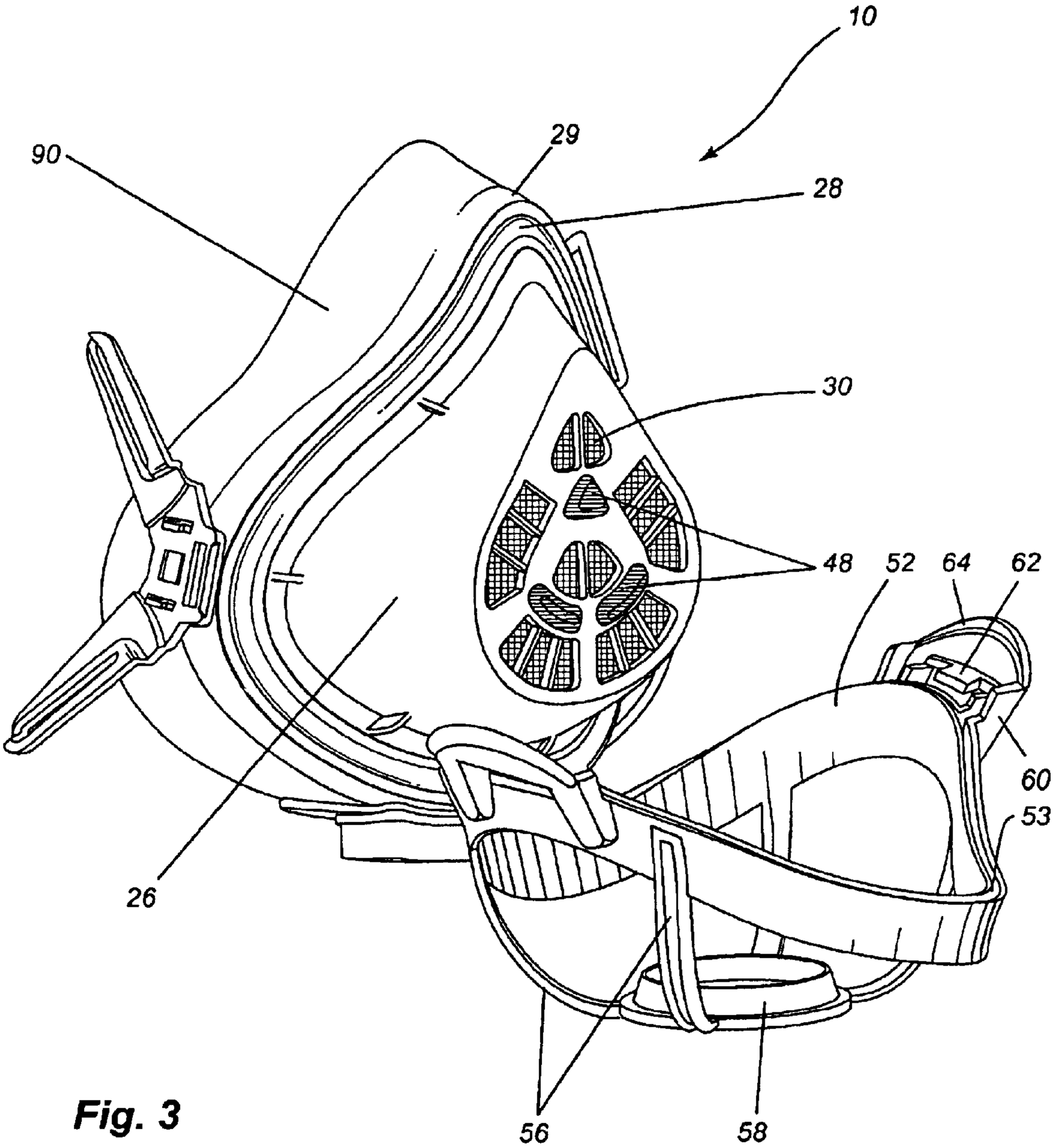

Fig. 3

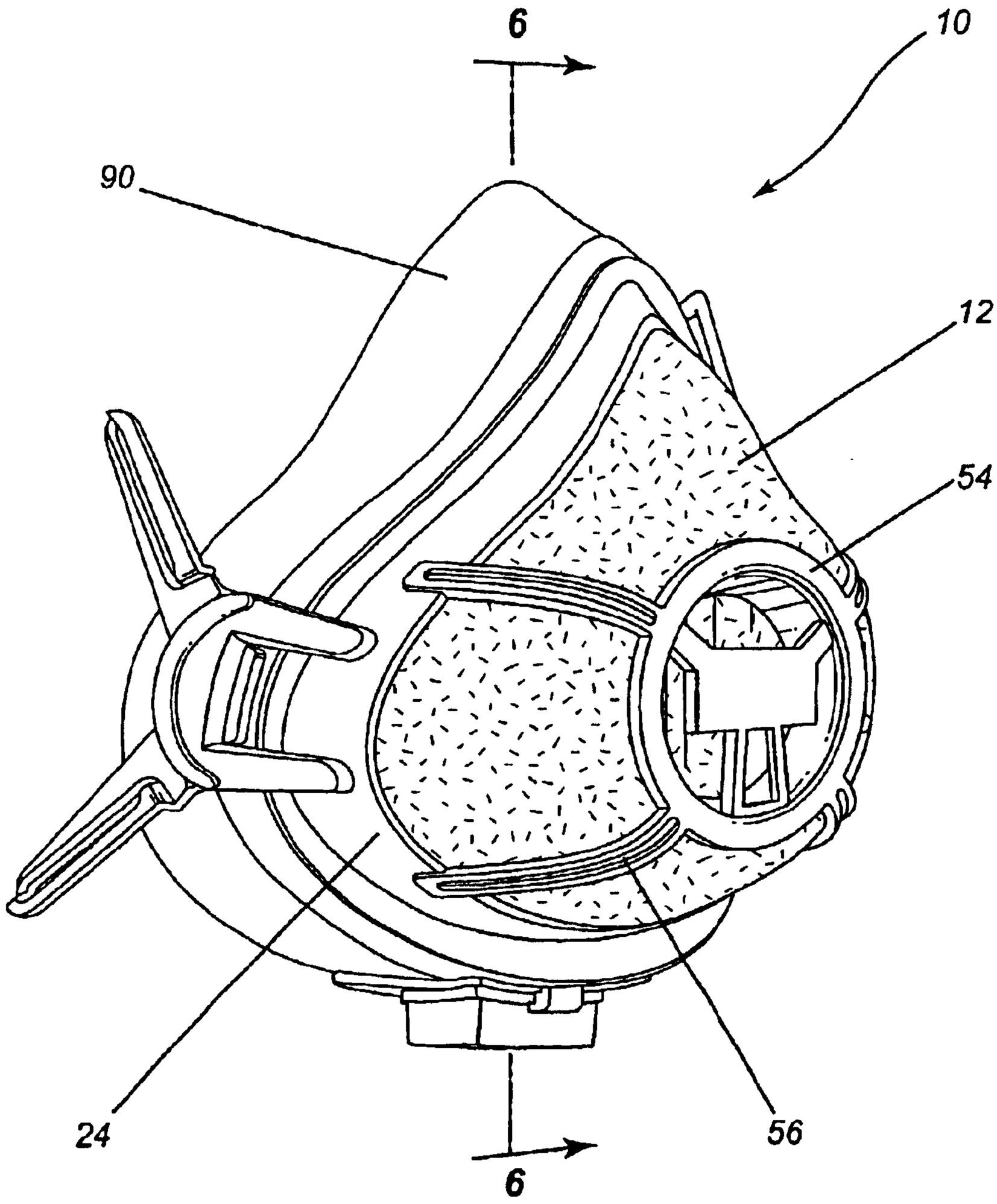

Fig. 4

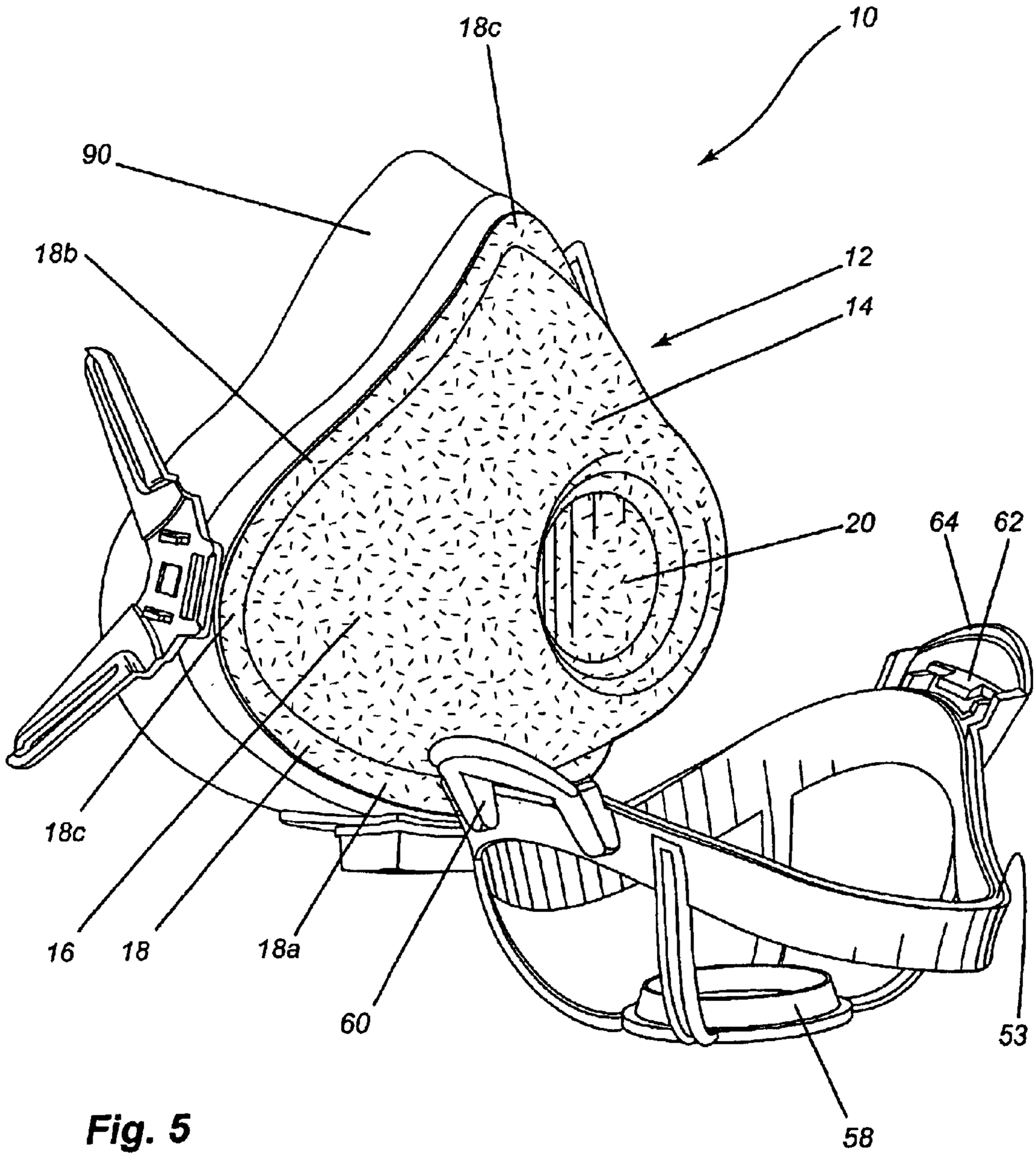

Fig. 5

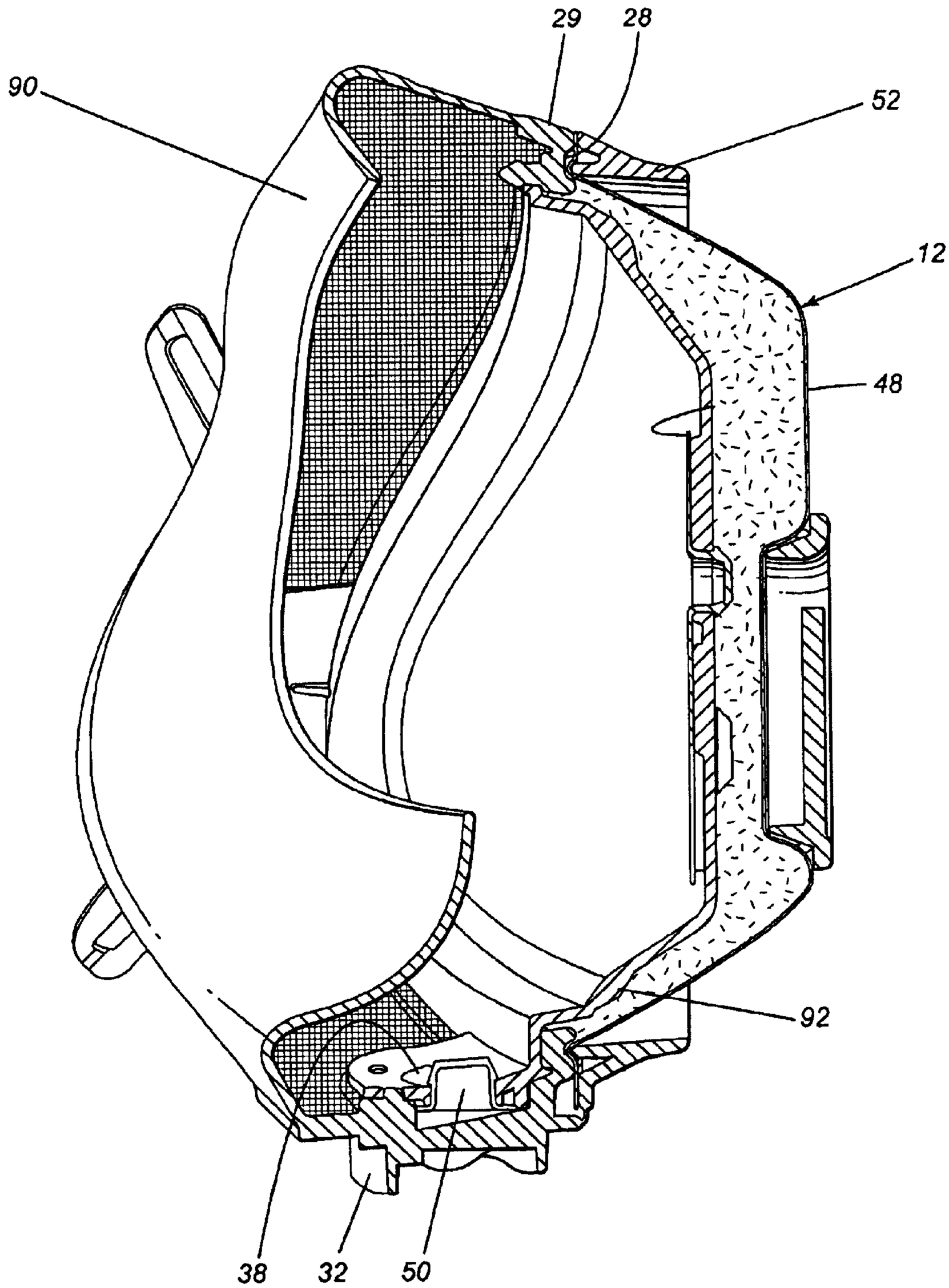

Fig. 6

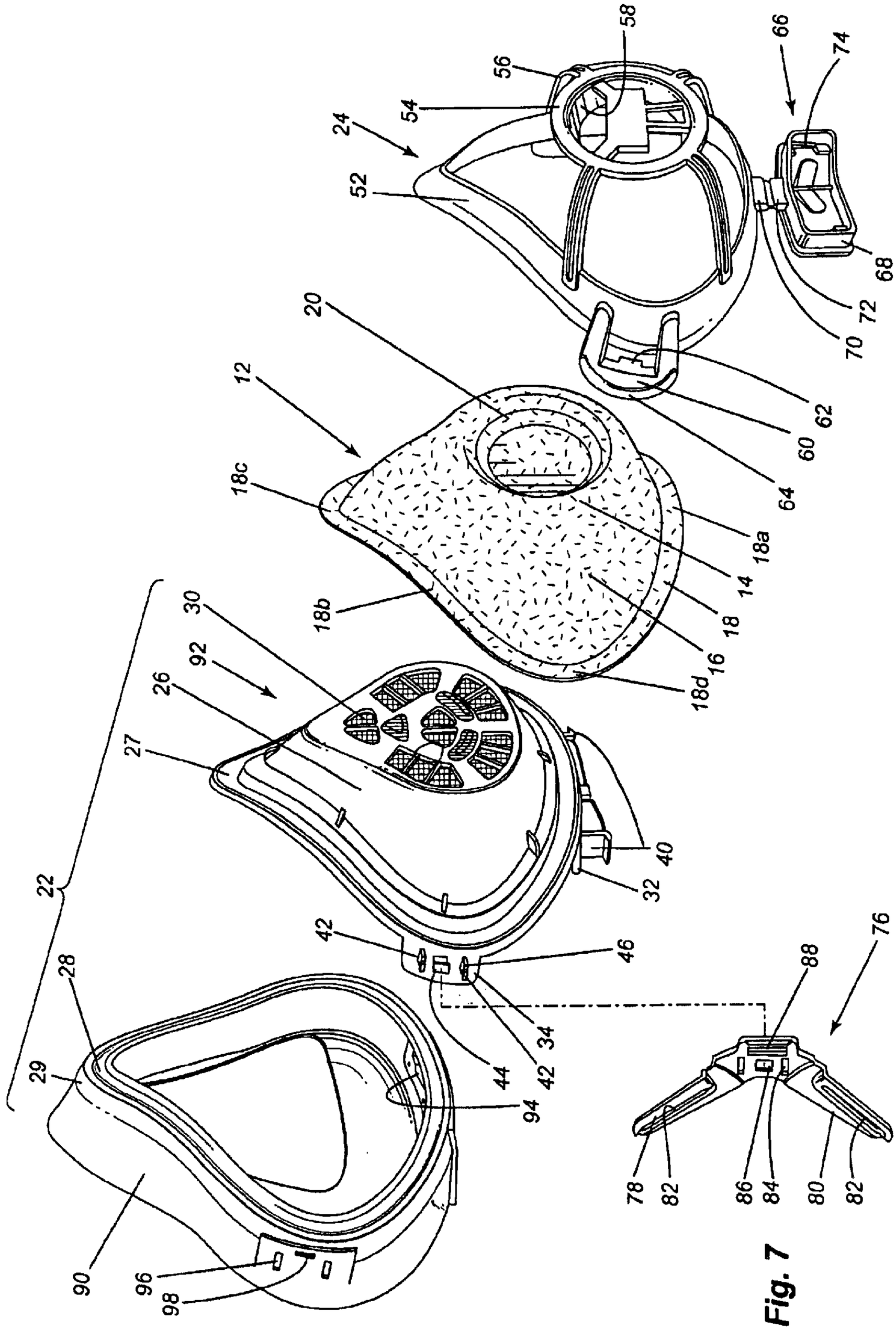
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Fig. 7

RESPIRATOR

RELATED APPLICATIONS

This application claims priority under 35 U.S.C. §120 to International Application No. PCT/CA01/01148, entitled, "Respirator," filed Aug. 10, 2001, which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

The present invention relates to a respirator comprising a facepiece and a cover. The cover is movable between a first position, in which the cover mates with the facepiece and a filter is received therebetween, to a second position, in which a wearer can install or remove the filter. The filter includes an apex portion, a side portion depending from the apex portion and a continuous flange portion surrounding said side portion and projecting laterally therefrom.

BACKGROUND OF THE INVENTION

Respirators are a common safety device used by people working in air contaminated environments. People such as construction workers often use respirators to prevent dust and other air contaminants from entering their respiratory tracts. Respirators are worn over the wearer's breathing passages and work to prevent the wearer from inhaling harmful substances when the wearer is in an environment that contains unsafe air particles.

A common respirator is the facepiece that simply comprises a permeable filtration media formed into a cup-shaped to fit the contour of the face of the wearer. This respirator comprises an elastic strap that extends around the head of the wearer. In other respirators a nose clip is attached to the respirator and is utilized to seek to obtain a seal around the nose area. Respirators of either type are disposable and cannot be used repeatedly since the filtration media becomes saturated after extended exposure to a contaminated environment.

Some tightly fitting respirators have a non-porous elastomeric facepiece that supports removable or permanently-attached filters.

There is a need in the industry to provide a novel respirator that can be used for long periods of time and will be comfortable.

SUMMARY OF THE INVENTION

As embodied and broadly described herein, the invention seeks to provide a respirator comprising: a facepiece having a cup shaped portion for sealingly engaging a face of a wearer and covering the mouth and nose of the wearer; a cover having a cup shape that is complementary to the cup shaped portion of said facepiece, said cover being capable to detachably mate with said facepiece to define with said facepiece a void area; and said void area being cup-shaped and suitable to receive a filter having a complementary shape.

As embodied and broadly described herein, the invention further seeks to provide a respirator comprising: a facepiece having a cup shaped portion for sealingly engaging a face of a wearer and covering the nose and mouth of the wearer; a cover having a cup shape that is complementary to the cup shaped portion of said facepiece, said cover being capable to detachably mate with said facepiece to define with said facepiece a void area; and a filter having a cup shape, said filter is received in said void area.

As embodied and broadly described herein, the invention further seeks to provide a disposable filter having a cup shape and dimensions such as to cover a wearer's mouth and nose, said disposable filter being adapted to be received in a void area defined between a facepiece and a cover of a respirator, said facepiece having a cup shaped portion for sealingly engaging a face of the wearer and covering the mouth and nose of the wearer, said cover having a cup shape that is complementary to the cup shaped portion of said face piece, said cover being capable to detachably mate with said facepiece.

Preferably, the facepiece comprises a first continuous surface and the cover comprises a second continuous surface, these continuous surfaces being complementary and operable to sealingly engage the filter therebetween when the facepiece is mated with the cover. These continuous surfaces surround the mouth and nose of the wearer. Furthermore, the facepiece comprises first and second parts, the first part being more pliable than the second part, the first part defining a continuous seal for sealingly engaging the face of the wearer and cover the mouth and nose of the wearer.

The respirator further comprises inhalation and exhalation valves mounted to the second part of the facepiece. The exhalation valve is designed to open in response to pressure from exhaled air and to remain closed between breaths and when the wearer inhales. Moreover, the cover is hingedly attached to the facepiece and comprises at least one releasable latch for locking the cover to the facepiece.

Most preferably, the facepiece comprises two V-shaped members, each V-shaped member having first and second branches, each of first and second branches has a longitudinal aperture adapted to receive a portion of a strap.

The filter preferably comprises a recess defined on the apex portion, the recess being generally circular. Furthermore, the flange of the facepiece includes first, second and third sections that are concave and that merge together through rounded corners. The filter has a generally triangular figure.

BRIEF DESCRIPTION OF THE DRAWINGS

A detailed description of the preferred embodiment of the invention is provided herein with reference to the following drawings, wherein:

FIG. **1** is a perspective view of a respirator constructed in accordance with an embodiment of the invention wherein the respirator is worn by a wearer;

FIG. **2** is a perspective view of the respirator of FIG. **1** without a disposable filter;

FIG. **3** is a perspective view of the respirator of FIG. **1**, without the filter and with the cover shown in a first position;

FIG. **4** is a perspective view of the respirator of FIG. **1** with the cover shown in a second position;

FIG. **5** is a perspective of the respirator of FIG. **1** wherein the cover is shown in the first position;

FIG. **6** is a cross section of the respirator of FIG. **1**; and

FIG. **7** is an exploded perspective view of the respirator of FIG. **1**.

In the drawings, preferred embodiments of the invention are illustrated by way of examples. It is to be expressly understood that the description and drawings are only for the purpose of illustration and are an aid for understanding. They are not intended to be a definition of the limits of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, FIGS. **1** to **7** illustrate a respirator constructed in accordance with an embodiment of

the present invention, which is generally designated by the reference number **10**. FIGS. **2** and **3** illustrate respirator **10** without a disposable filter.

Respirator **10** is reusable and is adapted to receive and maintain a disposable filter that may be designed to protect a wearer from particulate, dust, smoke, oil, fumes and/or gases or vapors. Respirator **10** is thus adapted to receive a variety of disposable filters that are designed to protect the wearer in different environmental conditions. The filters may be composed of any combination of filter media, protective layers and carbon media that will protect the wearer from breathing in the undesirable substances.

In a non-limiting example, respirator **10** is used as a particulate and gas/vapor respirator adapted to receive a disposable filter **12** comprising a particulate filter layer and a carbon media. Filter **12** has dimensions such as to cover the mouth and nose of a wearer and comprises an apex portion **14**, a side portion **16** depending from apex portion **14** and a continuous flange portion **18** surrounding side portion **16**, flange portion **18** projecting laterally from side portion **16**.

Flange portion **18** comprises a first section **18***a* that overlies the chin of the wearer. First section **18***a* is concave. Flange portion **18** also comprises second and third sections **18***b* and **18***c* merging with first section **18***a* through rounded corners **18***d*. Second and third sections **18***b* and **18***c* are concave to a lesser degree than first section **18***a*. Flange portion **18** defines a generally triangular figure. Filter **12** also comprises a generally circular recess **20** formed on apex portion **14**. The material of flange portion **18** may be compressed for increasing its rigidity.

Respirator **10** comprises two (2) main components, namely, a facepiece **22** and a cover **24**. Facepiece **22** has a first part **90** and a second part **92**. Second part **92** is made of a rigid or semi-rigid lightweight material such as plastic. First part **90** is more pliable than second part **92** and is made of a soft, flexible, elastomeric material such as natural rubber which provides added comfort to the wearer.

First part **90** surrounds the nose and mouth of the wearer in an attempt to prevent the wearer from inhaling the substances that respirator **10** aims to filter. In fact, first part **90** defines a continuous seal for sealingly engaging the face of the wearer and covering the mouth and nose of the wearer. First part **90** thus ensures that respirator **10** will fit many different faces and form a seal with the skin of the face of the wearer.

Second part **92** of facepiece **22** has a cup shaped portion **26** having a continuous surface **27** that extends laterally therefrom and encircles the nose and mouth of the wearer.

It is understood that first part **90** can be secured to second part **92** by different means such as mechanical securing means, chemical affixing means or through-molding processes. For instance, as best seen in FIGS. **3**, **6** and **7**, the first part **90** comprises a peripheral portion **29** covering the continuous surface **27** of the second part **92** for securing the first and second parts **90**, **92** together. The facepiece **22** has a continuous surface **28** formed on a peripheral portion **29** of the first part **90** for receiving the filter **12**.

Second part **92** of facepiece **22** comprises openings **30** through which the breath of the wearer can be inhaled. Since both facepiece **22** and filter **12** have a complementary cup shaped portion, filter **12** can be mounted on facepiece **22** and thus completely recovers openings **30** and continuous surface **28**.

Second part **92** of facepiece **22** comprises a bottom wall **32** and side walls **34**, all extending laterally and inwardly therefrom. As shown in FIG. **6**, bottom wall **32** comprises openings **38** through which the breath of the wearer can be exhaled and two spaced apart L-shaped protuberances **40**. Each side wall **34** comprises two spaced apart posts **42** and a L-shaped protuberance **44**, each post **42** having a notch **46**.

As shown in FIG. **6**, respirator **10** further comprises an inhalation valve **48** that recovers openings **30** and an exhalation valve **50** that recovers openings **38**. Inhalation valve **48** is designed to open in response to pressure from air inhaled by the wearer while exhalation valve **50** is designed to open in response to pressure from exhaled air and to ensure that the exhaled air does not pass back through filter **12** thereby preventing rebreathing of the exhaled air. Exhalation valve **50** is further designed to remain closed between the breaths of the wearer. Exhalation valve **50** is further useful as a diagnostic tool. In order to ensure that respirator **10** is properly sealed on the face of the wearer, the wearer must simply cover exhalation valve **50** and exhale. This will allow the wearer to check for leaks around the facial area or anywhere in respirator **10**. It is understood that the exhalation valve can be mounted on the filter.

Cover **24** is made of a rigid or semi-rigid lightweight material such as plastic and is adapted to be hingedly secured to facepiece **22**. Cover **24** has a cup shape that is complementary to cup shaped portion **26**. Cover **24** is detachably mated with facepiece **22** to define with facepiece **22** a void area therebetween that is also cup-shaped and suitable to receive filter **12**. Cover **24** is movable from a first position, in which the void area is opened allowing the installation or removal of filter **12**, to a second position, in which cover **24** mates with facepiece **22** and filter **12** is received in the void area.

Cover **24** comprises a peripheral portion **52** and a ring **54**, peripheral portion **52** and ring **54** being connected together by four branches **56**. Peripheral portion **52** has a continuous surface **53** that surrounds the mouth and nose of the wearer. Ring **54** comprises an annular band **58** that extends inwardly therefrom. Cover **24** further comprises two C-shaped latches **60** extending from peripheral portion **52**, each C-shaped latch **60** comprises a protuberance **62** and a finger responsive portion **64**. Cover **24** also comprises a securing member **66** having a generally rectangular section **68** secured to peripheral portion **52** by a connector **70** having a groove **72**. Section **68** comprises two internal notches **74**.

Although cover **24** has been described herein as having branches **56** and a ring **54**, it should be expressly understood that cover **24** could be of many configurations, so long as air is able to pass through cover **24** and reach facepiece **22** through filter **12**. In an alternate embodiment, the cover could be made of a meshed metal. It is also understood that securing member **66** can be replaced by other securing means for securing cover **24** to facepiece **22**. For example, a hinge-like connector, a strap, a hook and eye, or a press-stud can be used for securing facepiece **22** and cover **24** together.

Respirator **10** further comprises two V-shaped members **76**, each V-shaped member **76** comprising first and second branches **78** and **80**, each of branches **78** and **80** having a longitudinal aperture **82**. Each V-shaped member **76** also comprises two spaced apart apertures **84** and an aperture **86** for receiving therein spaced apart posts **42** and L-shaped protuberance **44** respectively. Moreover, each V-shaped member **76** comprises a rectangular aperture **88** for receiving therein protuberance **62**.

First part **90** comprises an aperture **94** through which L-shaped protuberances **40** of bottom wall **32** of facepiece **22** can pass. At each side, first part **90** also comprises

openings **96** and an opening **98** through which posts **42** and L-shaped protuberance **44** can respectively pass.

When respirator **10** is assembled, first part **90** is notably sandwiched between bottom wall **32** and securing member **66** and between side walls **34** and V-shaped members **76**. Each V-shaped member **76** is attached to body **22** when spaced-apart posts **42** and L-shaped protuberance **44** are clipped within apertures **84** and aperture **86** respectively. Cover **24** is hingedly attached to body **22** when each L-shaped protuberance **40** is clipped within internal notch **74**.

As shown in FIG. **1**, respirator **10** further comprises a strap **100** for holding respirator **10** over the head of the wearer. Each longitudinal aperture **82** of V-shaped member **76** allows insertion of a portion of strap **100**.

It is understood that V-shaped members **76** can be secured to first part **90** instead of being secured to second part **92**. It is also understood that cover **24** can be hingedly attached to first part **90** instead of being hingedly attached to second part **92**. Yet, it is understood that first part **90** can comprise an aperture for receiving therein protuberance **62** of C-shaped latch **60** of cover **24**. It is understood that it is not necessary for cover **24** to be hingedly attached to facepiece **22** as strap **100** can be attached to cover **24** by way of apertures similar to **82** on branches **78** and **82**. Lastly, it is understood that strap **100** or other means of securing the respirator can be affixed by a variety of means, for example eyelets, rivets or adhesives.

FIGS. **3** and **5** show cover **24** in a first position in which the wearer can install or remove filter **12**. FIG. **4** shows cover **24** in a second position wherein cover **24** mates with facepiece **22** and the filter is received in the void area defined between cover **24** and facepiece. In the second position, continuous surface **28** of facepiece **22** is complementary with continuous surface **53** of cover **24** for sealingly engaging therebetween flange portion **18** of filter **12**. In fact, flange portion **18** of filter **12** is compressed against continuous surface **28** of facepiece **22** by cover **24** thereby forming an airtight seal between facepiece **22** and filter **12**.

In use, cover **24** is moved to the first position and filter **12** is then mounted on facepiece **22** so that filter **12** entirely covers openings **30**. Once filter **12** has been installed, cover **24** is moved into the second position so that protuberance **62** of C-shaped latches **60** engages into aperture **88** of V-shaped members **76**. In order to do so, the wearer can use finger responsive portions **64**. It is understood that cover **24** is hingedly attached to facepiece **22** and groove **72** of connector **70** allows moving cover **24** between first and second positions.

Once the wearer has finished using respirator **10**, or once filter **12** is saturated, the wearer can simply pull finger responsive portions **64** until protuberances **62** release from apertures **88** of V-shaped members **76**, thereby causing cover **24** to disengage from facepiece **22** and move to the second position. At this point the wearer may then remove filter **12** which can be thrown away and replaced with a new disposable filter, thereby allowing respirator **10** to be reused.

The above description of preferred embodiments should not be interpreted in a limiting manner since other variations, modifications and refinements are possible within the spirit and scope of the present invention. The scope of the invention is defined in the appended claims and their equivalents.

What is claimed is:

1. A disposable filter having a cup shape and dimensions such as to cover a wearer's mouth and nose, said disposable filter being adapted to be received in a void area defined between a facepiece and a cover of a respirator, said facepiece having a cup shaped portion for sealingly engaging a face of the wearer and covering the mouth and nose of the wearer, said cover having a cup shape that is complementary to the cup shaped portion of said face piece, said cover being capable to detachably mate with said facepiece, wherein said filter comprises an apex portion, a side portion depending from said apex portion and a continuous flange portion surrounding said side portion, said flange portion projecting laterally from said side portion.

2. A disposable filter as defined in claim **1**, wherein said apex portion comprises a generally circular recess.

3. A disposable filter as defined in claim **1**, wherein said flange portion includes a section that overlies a chin of the face of the wearer, said section being concave.

4. A disposable filter as defined in claim **3**, wherein said section is a first section, said flange includes second and third sections, said second and third sections being concave to a lesser degree than said first section.

5. A disposable filter as defined in claim **4**, wherein said first section merges with said second and third sections through rounded corners.

6. A disposable filter as defined in claim **1**, wherein said flange portion defines a generally triangular figure.

7. A respirator for a wearer having a face, a mouth and a nose, said respirator comprising:

(a) a facepiece comprising first and second parts, said first part being more pliable than said second part, said second part comprising an apex portion, a side portion depending from said apex portion and a continuous surface extending laterally therefrom and encircling the mouth and nose of the wearer, said first part comprising a peripheral portion covering said continuous surface of said second part and extending inwardly for defining a continuous seal sealingly engaging the face of a wearer and encircling the nose and mouth of the wearer; and

(b) a cover comprising a continuous flange portion that is complementary to said peripheral portion of said first part, said cover being capable to detachably mate with said facepiece to define with said facepiece a void area; said void area being cup-shaped for receiving a filter having a complementary shape.

8. A respirator as defined in claim **7**, wherein said peripheral portion of said first part comprises a first continuous surface and said continuous flange of said cover comprises a second continuous surface, said first and second continuous surfaces being complementary and operable to sealingly engage the filter therebetween when said facepiece is mated with said cover.

9. A respirator as defined in claim **8**, wherein said facepiece comprises an inhalation valve mounted to said second part.

10. A respirator as defined in claim **9**, wherein said facepiece comprises an exhalation valve mounted to said second part.

11. A respirator as defined in claim **7**, wherein said first part is made of an elastomeric material.

12. A respirator as defined in claim **7**, wherein said cover is movable from a first position, in which said void area is opened allowing the installation or removal of the filter, to a second position, in which said cover mates with said facepiece and the filter is received in said void area.

13. A respirator as defined in claim **12**, wherein said cover is hingedly attached to said facepiece second part.

14. A respirator as defined in claim **13**, wherein said cover comprises at least one releasable latch for locking said cover in said second position.

15. A respirator as defined in claim 14, wherein said facepiece comprises a strap over the head of the wearer for holding said respirator.

16. A respirator as defined in claim 15, wherein said facepiece comprises a V-shaped member having first and second branches, each said first and second branches comprising an aperture through which a portion of said strap passes.

17. A respirator as defined in claim 16, wherein said cover comprises a peripheral portion and a ring connected together by at least one branch, said peripheral portion comprising said second continuous surface, said ring comprising an annular band that extends inwardly therefrom.

18. A respirator as defined in claim 17, wherein said annular band engages the periphery of a central recess formed on a filter.

19. A respirator for a wearer having a face, a nose and a mouth, said respirator comprising:

(a) a facepiece comprising first and second parts and a continuous surface, said first part being more pliable than said second part, said second part comprising an apex portion, a side portion depending from said apex portion and a continuous surface extending laterally therefrom and encircling the nose and mouth of the wearer, said first part extending inwardly from said second part for defining a continuous seal sealingly engaging the face of a wearer and encircling the nose and mouth of the wearer;

(b) a cover comprising a continuous flange portion that is complementary to said continuous surface of said facepiece, said cover being capable to detachably mate with said facepiece to define with said facepiece a void area; and

(c) a filter comprising an apex portion, a side portion depending from said apex portion, and a continuous flange portion surrounding said side portion, said flange portion projecting laterally from said side portion, said filter being received in said void area.

20. A respirator as defined in claim 19, wherein said first part comprises a peripheral portion covering said continuous surface of said second part, wherein said continuous surface of said facepiece is a first continuous surface formed on said first part and wherein said continuous flange portion of said cover comprises a second continuous surface, said first and second continuous surfaces being complementary and operable to sealingly engage said filter therebetween when said facepiece is mated with said cover.

21. A respirator as defined in claim 20, wherein said facepiece comprises an inhalation valve mounted to said second part.

22. A respirator as defined in claim 21, wherein said facepiece comprises an exhalation valve mounted to said second part.

23. A respirator as defined in claim 19, wherein said first part is made of an elastomeric material.

24. A respirator as defined in claim 19, wherein said cover is movable from a first position, in which said void area is opened allowing the installation or removal of said filter, to a second position, in which said cover mates with said facepiece and said filter is received in said void area.

25. A respirator as defined claim 24, wherein said cover is hingedly attached to said facepiece.

26. A respirator as defined in claim 25, wherein said cover comprises at least one releasable latch for locking said cover in said second position.

27. A respirator as defined in claim 26, wherein said facepiece further comprises a strap over the head of the wearer for holding said facepiece.

28. A respirator as defined in claim 27, wherein said facepiece comprises a V-shaped member having first and second branches, each said first and second branches comprising an aperture through which a portion of said strap passes.

29. A respirator as defined in claim 28, wherein said cover comprises a peripheral portion and a ring connected together by at least one branch, said peripheral portion comprising said second continuous surface, said ring comprising an annular band that extends inwardly therefrom.

30. A respirator as defined in claim 29, wherein said annular band engages the periphery of a central recess formed on said filter.

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